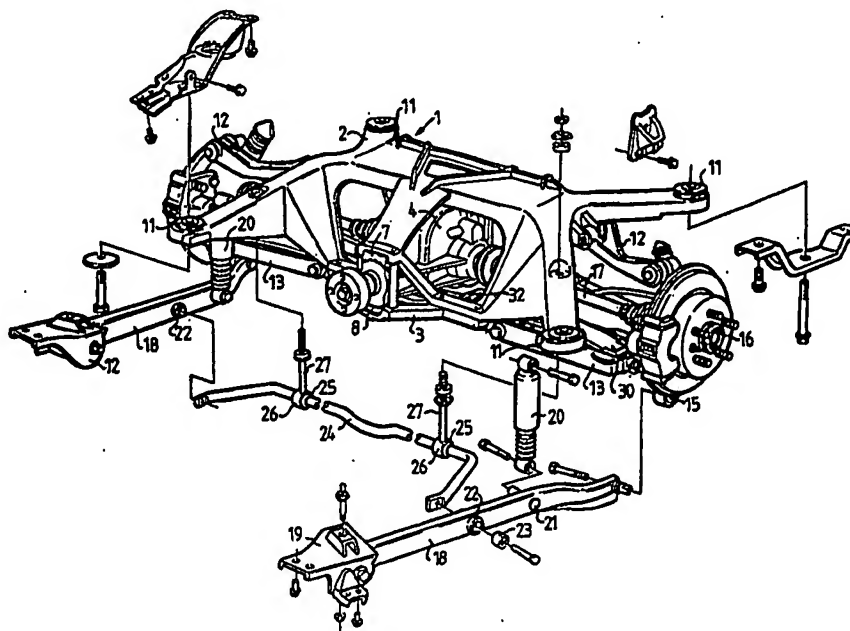


## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: PCT/SE95/00789 (22) International Filing Date: 27 June 1995 (27.06.95) (30) Priority Data: 9402275-3 28 June 1994 (28.06.94) SE (71) Applicant (for all designated States except US): AB VOLVO [SE/SE]; S-405 08 Gothenburg (SE). (72) Inventors; and (75) Inventors/Applicants (for US only): ZETTERSTRÖM, Sigvard [SE/SE]; Prilyckegatan 425, S-425 32 Hisings Kärä (SE). SJÖSTEN, Kjell [SE/SE]; Näsets Vinkelväg 8, S-421 66 Västra Frölunda (SE). (74) Agents: HELLBOM, Lars et al.; H. Albihs Patentbyrå AB, P.O. Box 3137, S-103 62 Stockholm (SE).</p>		<p>(81) Designated States: AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LT, LU, LV, MD, MG, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TT, UA, UG, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG), ARIPO patent (KE, MW, SD, SZ, UG).  Published With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments. In English translation (filed in Swedish).</p>

(54) Title: WHEEL SUSPENSION FOR A PAIR OF DRIVEN VEHICLE WHEELS



## (57) Abstract

Wheel suspension for a pair of driven motor vehicle wheels, comprising a member (1), which consists of two cast aluminium member elements (2, 3) which are joined to each other. The member is intended to be fixed to a vehicle undercarriage. A wheel carrier (15) for each wheel is carried by the member via an upper and a lower link arm (12, 13), a slotted rod (14) and a longitudinal bar (18). A final drive unit (4) is fixed to the member together with a transverse leaf spring (30), which forms the wheel spring system, without the use of any special through-fasteners.

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## Wheel Suspension for a pair of driven vehicle wheels

The present invention relates to a wheel suspension for a pair of driven motor vehicle wheels, comprising a member intended to be fixed to a vehicle undercarriage, for each wheel an upper and a lower link arm pivotally joined to a wheel carrier, a longitudinal bar pivotally connectable to the vehicle undercarriage and pivotally connected to the wheel carrier, a slotted rod pivotally joined to the member and to the respective wheel carrier, spring means acting between the respective wheel carrier and the member, shock absorbers and an anti-roll bar, a differential carried by the member, and a pair of wheel axles driven by the differential transmission, said axles each being joined to an individual wheel hub mounted in the respective wheel carrier.

SE-A-458 514, for example, describes a wheel suspension of the type described by way of introduction, which provides high comfort and good road properties in the vehicle by, among other things, achieving stabilisation and equalisation of forces affecting the rear wheels, in order to avoid undesired steering of the rear wheels. Furthermore, the known wheel suspension provides a relatively large amount of space for various installations in the area around the rear wheels.

The wheel suspension known by SE-A-458 514 has a member system comprised of a plurality of pressed sheet metal parts which are welded together. In order to compensate for unavoidable tolerance deviations, the lower link arm and the slotted rod are fixed to the member by means of bolts with excentric bushings, so that the correct camber angle and toe-in of the wheels can be adjusted after mounting.

The differential is screwed securely to the member. The longitudinal arms act as supporting arms for the wheel spring system and helical springs arranged concentrically therewith, said springs resting against seats on the tops of the supporting arms. An anti-roll bar is joined to the member on the rear side of the member via links with caps screwed securely

over the rubber bushings, which grip over the anti-roll bar.

5 The purpose of the present invention is to achieve a wheel suspension of the type described by way of introduction, which, while retaining the positive features of the known wheel suspension described above as regards comfort and ride can be manufactured at lower cost and be made lighter.

10 This is achieved according to the invention by virtue of the fact that the member comprises an upper and a lower member element, said elements being screwed securely to each other and fixing the differential between them via elastic damping elements.

15 A cast aluminum member system can be manufactured with much closer tolerances than the previously known system consisting of pressed sheet metal components which are welded together. This also means that the link arm and the slotted rod can be joined to the member by means of screw fasteners which are  
20 free of play, e.g. serration screws, since after-adjustment will no longer be needed. By clamping the differential between the upper and lower member elements, simple assembly is achieved. No through-fixing elements are required to keep the differential in place, only screw fasteners which hold the  
25 member elements together.

30 In a wheel suspension of the type described by way of introduction, by replacing, in accordance with the invention, the conventional helical springs of the suspension with a transverse leaf spring, which has a central portion securely fixed to the member and end portions acting against a top side of each lower link arm, it is possible to achieve a design which saves weight and space. By virtue of the fact that the longitudinal bars no longer need to serve as supporting arms for  
35 the wheel springs but are primarily bars for fixing the wheel carrier in the longitudinal direction of the vehicle, their design can be simplified and their dimensions be reduced.

The free space in front of the member between the longitudi-

nal bars can be used with advantage for a U-shaped curved anti-roll bar, which is joined to each longitudinal bar and to the member, the connection between the longitudinal bars lying approximately midway between the ends of each bar. Such a design provides better efficiency for the anti-roll bar than does the previously known design with the anti-roll bar placed behind the member.

The invention will be described in more detail with reference to examples shown in the accompanying drawings, where Fig. 1 and 2 show two exploded views of a preferred embodiment of a wheel suspension according to the invention, in two different states of assembly, and Fig. 3 shows the wheel suspension of Fig. 1 and 2 after final assembly but before being mounted in the vehicle.

The wheel suspension according to the invention is a direct further development of the wheel suspension shown in SE-A-458 514. The basic geometry, function and properties are the same in the two wheel suspensions and therefore will not be dealt with in more detail here. For a detailed description, reference is made to SE-A-458 514.

According to the invention, a rear axle member (Fig. 3), generally designated 1, comprises an upper member element 2 and a lower member element 3, which are made of chill-cast aluminum and are fixed to each other by means of a screw fastener. Member elements 2,3 are cast with forward and rear seats for a final drive unit 4 (differential), of which only the front seats 5 and 6 are shown in more detail. When the member elements 1 and 2 are screwed together, the final drive unit 4 is clamped between forward and rear blocks of elastic material, e.g. rubber, of which only the forward blocks 7 and 8 are visible in the Figures.

The upper member element 2 is cast with two forward arms 9 and two rear arms 10, in the ends of which there are elastic bushings 11 in bores. Via screws through the bushings 11, the rear axle member 1 is screwed securely to the undercarriage

of the vehicle. In the upper member element 2, an upper link arm 12 is pivotally mounted. A lower link arm 13 is pivotally mounted in the lower member element 3 as is a slotted rod 14. The link arms 12,13 and the slotted rod 14 have distal ends, which are pivotally mounted in the wheel carrier 15, in which a wheel hub 16 is rotatably mounted. Said wheel hub 16 is drivingly connected via splines to a drive shaft 17 driven by the final drive unit 4. The wheel carrier 15 is pivotally joined to one end of a longitudinal bar 18 (Fig. 2 and 3), the other end of which is pivotally mounted in a bracket 19 which is intended to be screwed securely to the undercarriage of the vehicle.

Completely cylindrical tubes are used as starting blanks for the longitudinal bars 18, which are mandrelled, flattened and bended in a plurality of planes to the shape shown in the Figures. The lower end of a shock absorber 20 is mounted on a pin 21 fixed to the bar 18. The upper end is intended to be fixed in a conventional manner to the undercarriage of the vehicle. A bushing sleeve 22 is fixed in a through-bore in the bar 18. Said sleeve houses a rubber bushing 23 with an inner bushing sleeve for fixing the ends of a U-shaped anti-roll bar 24 in each longitudinal bar 18. Rubber bushings 25 are vulcanized onto the anti-roll bar 24 and sleeves 26 are forced thereon. Each sleeve 26 is made in one piece with an associated link 27, for example, in a high-strength plastic material, such as nylon. As is particularly evident from Fig. 2, the mounting point of the anti-roll bar 24 in the longitudinal bar 18 is approximately midway between the ends of said bar 18. This makes the anti-roll bar highly efficient. The integrated design of the anti-roll bar 24 and the links 27 together with the bushings 22,23 in through-holes in the longitudinal bars 18 provides a simple, reliable and easily assembled design.

Instead of a conventional wheel suspension system with a pair of helical springs arranged concentrically with the shock absorbers, the wheel suspension according to the invention has a transverse wave-shaped preformed leaf spring 30, which

is common to the two wheels. The leaf spring 30 has a central portion or a midportion 31. Caps 32, which are screwed securely to the lower member element 3 and which carry shear-soft rubber blocks 33 vulcanized thereto, fix the midportion 31 to the member element 3. At their ends, the leaf spring 30 is in contact with its underside against rubber blocks 34, which are held in seats 35 at the top of the outer end of each lower link arm 13. The spring 30 thus passes below the final drive unit 4 and is fixed so that the space between the final drive unit 4 and the ground-free-passage line is minimized. The spring 30 lacks, as does the final drive unit 4, fixing elements which pass through them. The rubber blocks 33 of the caps 32 are intended, when the wheels are pushed far up, to be compressed and permit a certain amount of movement of adjacent spring portions upwards, thus contributing to reducing the downward deflection of the center portion 31 of the spring.

All of the mountings and joints described above are elastic and thus lack surfaces which slide against each other. The wheel suspension requires, in principle, no maintenance, and the only components which require replacement during the life of the vehicle are the shock absorbers.

## Claims

1. Wheel suspension for a pair of driven motor vehicle wheels, comprising a member intended to be fixed to a vehicle undercarriage, for each wheel an upper and a lower link arm pivotally joined to a wheel carrier, a longitudinal bar  
5 pivotally connectable to the vehicle undercarriage and pivotally connected to the wheel carrier, a slotted rod pivotally joined to the member and to the respective wheel carrier, spring means acting between the respective wheel carrier and the member, shock absorbers and an anti-roll bar, a differential  
10 carried by the member, and a pair of wheel axles driven by the differential, said axles each being joined to an individual wheel hub mounted in the respective wheel carrier, characterized in that the member comprises an upper and a lower cast aluminum member element (2,3), said elements being  
15 screwed securely to each other and fixing the final drive unit (4) between them via elastic damping elements (7,8).

2. Wheel suspension according to Claim 1, characterized in that the spring means are formed of a transverse leaf spring  
20 (30), which has a central portion (31) securely fixed to the member (1), and end portions acting against a top side (35) of each lower link arm (13).

3. Wheel suspension according to Claim 2, characterized in that the leaf spring (30) consists of fiberglass reinforced epoxy plastic.  
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4. Wheel suspension according to Claim 2 or 3, characterized in that the central portion (31) of the leaf spring (30) is  
30 in contact with its upper surface with at least one pair of spaced elastic damping elements (33), which, when compressed during the upward resilient movement of the wheels, permits a certain displacement upwards of the portions of the spring abutting against the damping elements, to reduce, during the  
35 resilient movement, the deflection downwards of the spring portion located between the damping elements.



5. Wheel suspension according to one of Claims 1-4, characterized in that a U-shaped curved anti-roll bar (24) is joined to each longitudinal bar (18) and to the member (1), the connection to each longitudinal bar lying approximately midway between the two ends of said longitudinal bar.

6. Wheel suspension according to Claim 5, characterized in that the anti-roll bar (24) is joined to the upper member element (2) via a pair of vertical links (27), each of which having at its lower end a sleeve (26) integral with said link, said sleeve being forced over a bushing (25) of elastic material adhesively fixed to the anti-roll bar.

7. Wheel suspension according to Claim 6, characterized in that the bushing (25) of elastic material is a rubber bushing securely vulcanized to the anti-roll bar (24).

8. Wheel suspension according to one of Claims 5-7, characterized in that the shock absorbers (20) are fixed in a respective longitudinal bar (18) at a point which is located between the point of attachment of the anti-roll bar (24) to the longitudinal bar and the wheel carrier (15).

9. Wheel suspension for a pair of driven motor vehicle wheels, comprising a member designed to be fixed to a vehicle undercarriage, for each wheel an upper and a lower link arm pivotally joined to the member and to a wheel carrier, a longitudinal rod pivotally connectable to the vehicle undercarriage and to the respective wheel carrier, a slotted rod pivotally joined to the member and to the respective wheel carrier, spring means, shock absorbers and an anti-roll bar acting between the respective wheel carrier and the member, a differential carried by the member, and a pair of wheel axles driven by the differential and which are joined to individual wheel hubs mounted in respective wheel carriers, characterized in that the spring means are formed by a transverse leaf spring (30), which has a central portion (31) securely fixed to the member (1), and end portions acting against a top side (35) of each lower link arm (13).

10. Wheel suspension according to Claim 9, characterized in that the leaf spring (30) consists of fiberglass reinforced epoxy plastic.

5 11. Wheel suspension according to Claim 9 or 10, characterized in that the central portion (31) of the leaf spring (30) is in contact with its top side against at least a pair of spaced elastic damping elements (33) which, during compression as the wheels move resiliently upwards, permits a certain displacement upwards of the portions of the spring in contact with the damping elements in order to reduce, during the resilient movement, the deflection downwards of the spring portion between the damping elements.

15 12. Wheel suspension according to Claim 11, characterized in that the end portions of the leaf spring (30) abut against the upwardly facing surfaces (35) of the lower link arms (13) via elastic damping elements (34).

20 13. Wheel suspension for a pair of driven motor vehicle wheels, comprising a member intended to be fixed to a vehicle undercarriage, for each wheel upper and lower link arms pivotally joined to a wheel carrier, a longitudinal bar pivotally connected to the vehicle undercarriage and pivotally connected to the respective wheel carrier, a slotted rod pivotally connected to the member and to the respective wheel carrier, spring means, shock absorbers and an anti-roll bar acting between the respective wheel carrier and the member, a differential carried by the member, and a pair of wheel axles driven by the differential, said wheel axles being joined to individual wheel hubs mounted in respective wheel carriers, characterized in that a U-shaped curved anti-roll bar (24) is joined to each longitudinal bar (18) and to the member (1), the connection to the respective longitudinal bar being approximately midway between the two ends of the longitudinal bar.

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14. Wheel suspension according to Claim 13, characterized in that the anti-roll bar (24) is joined to the upper member

element (2) via a pair of vertical links (27), each having at its lower end a bushing (26) integral with said link and which is forced over a bushing (25) of elastic material adhesively fixed to the anti-roll bar.

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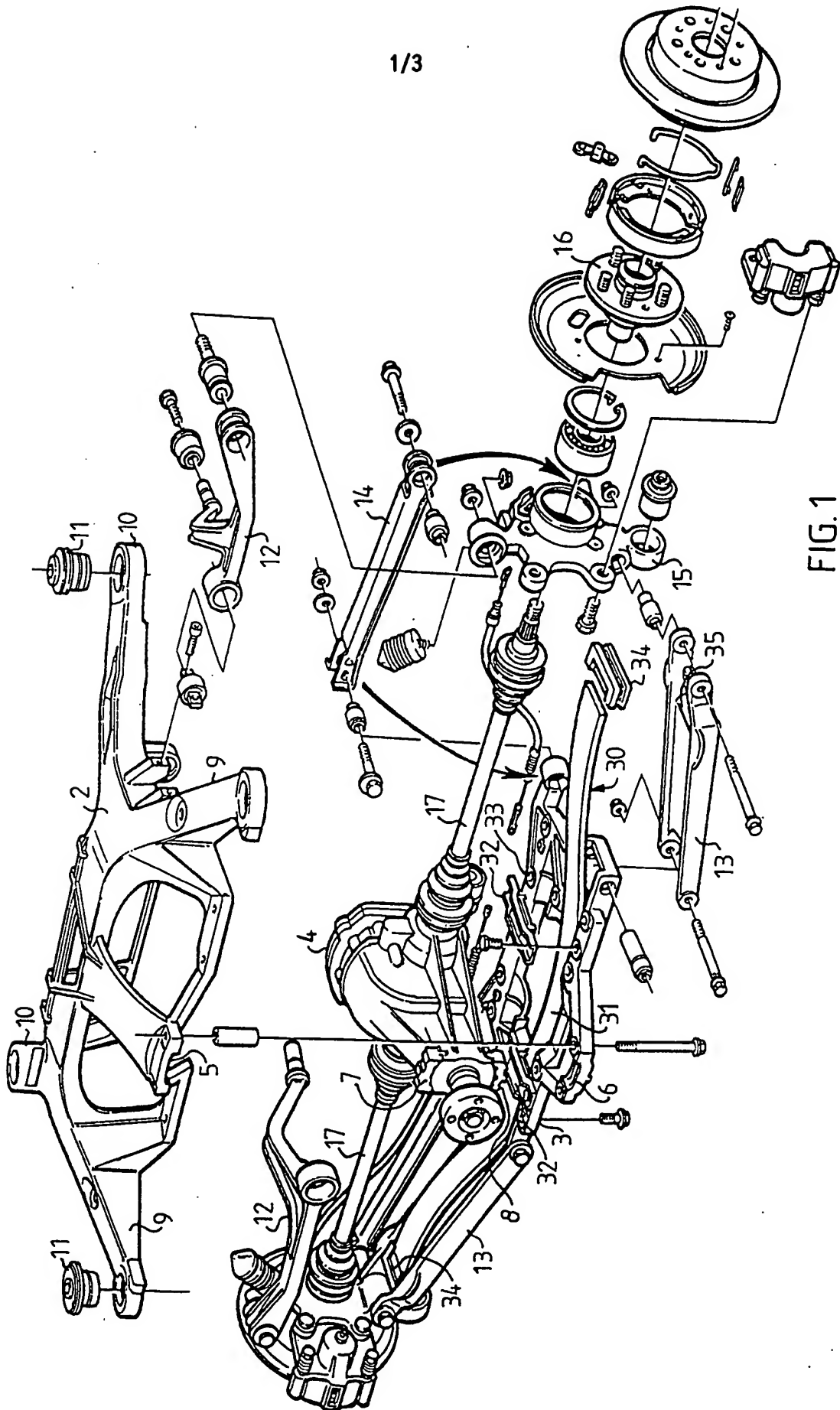
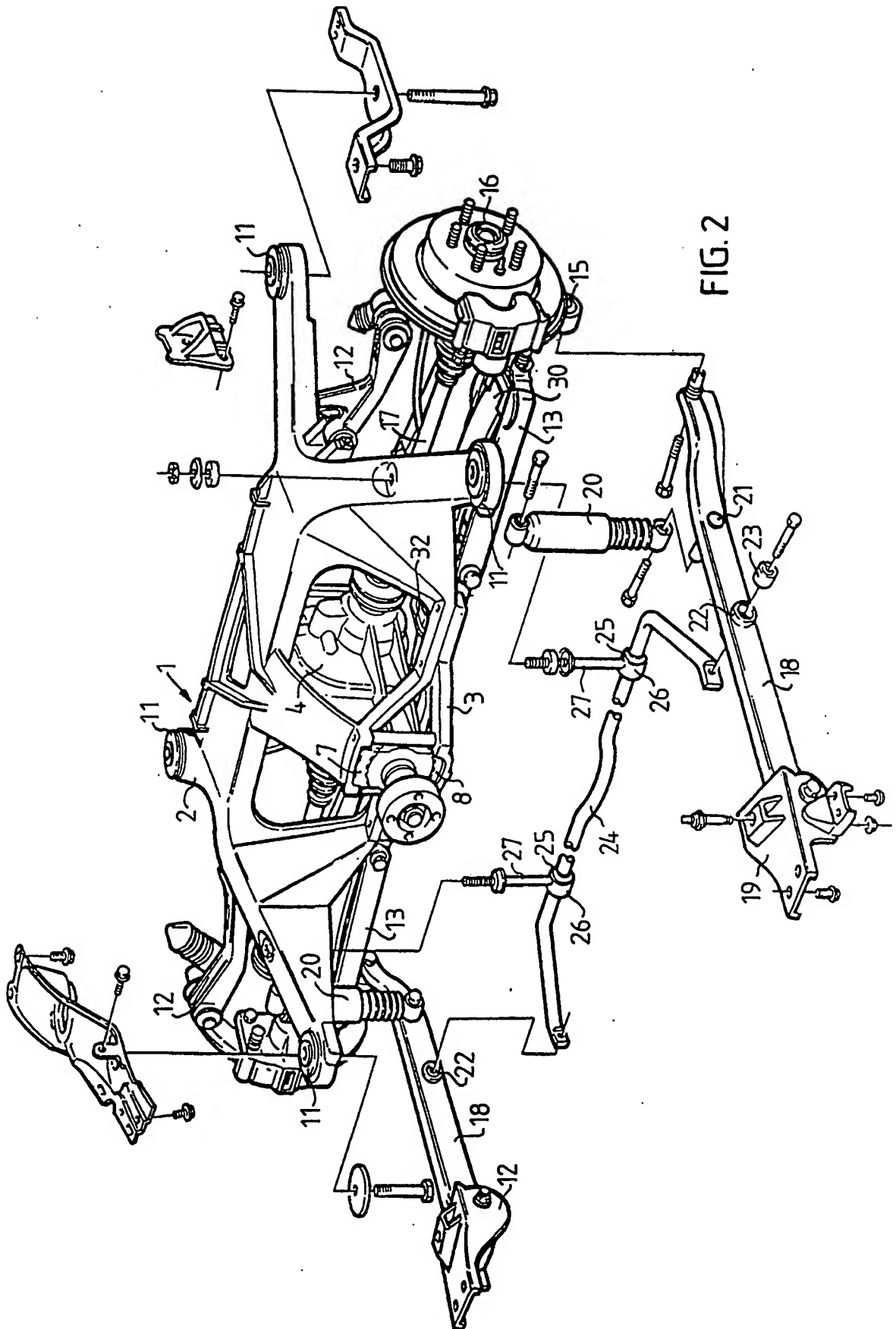
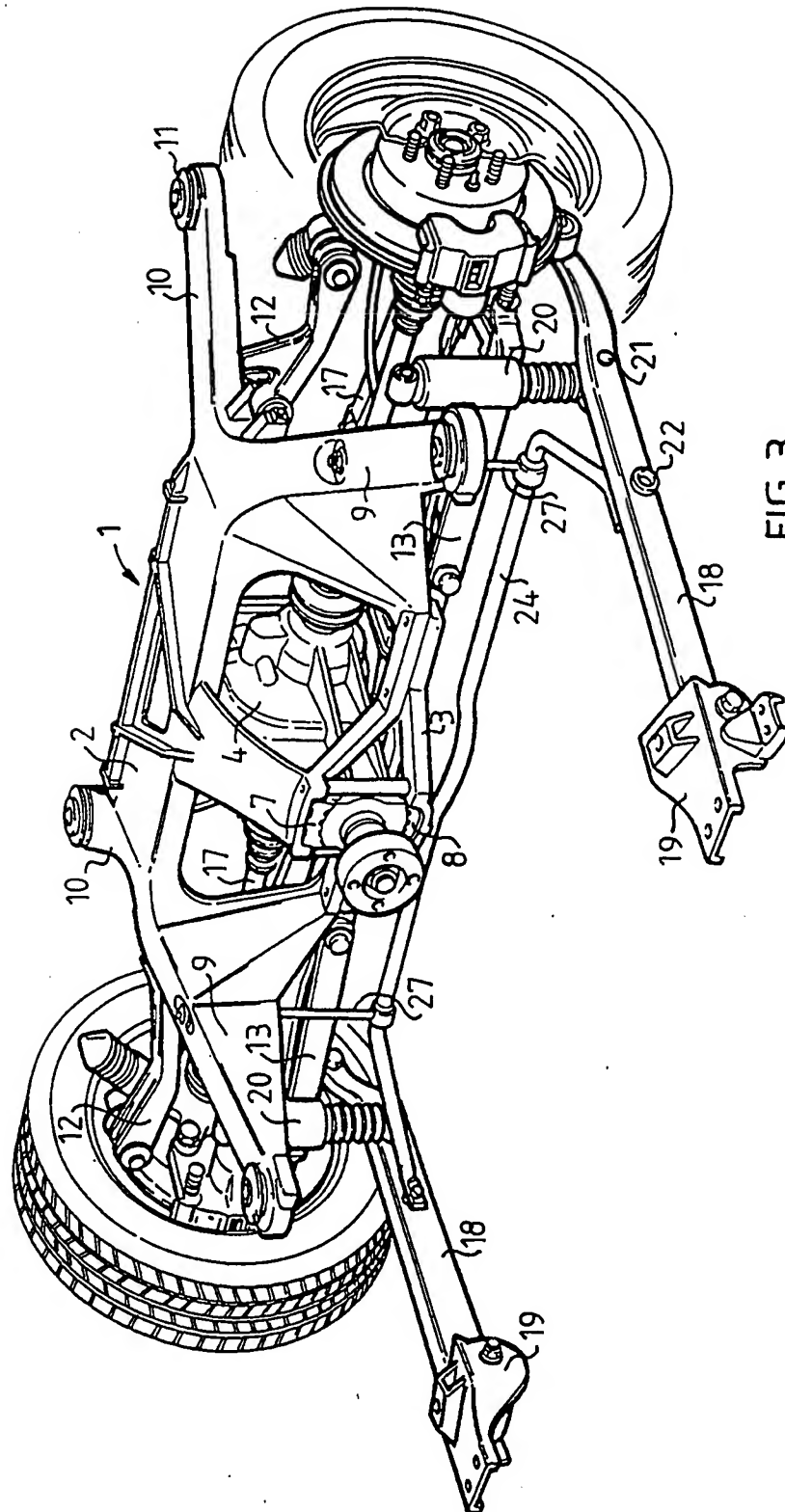


FIG. 1





# SUBSTITUTE SHEET

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 95/00789

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B60G 3/20, B62D 29/00, B60G 11/08, B60G 21/055

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B60G, B62D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 1132006 B (OTTO OECKL), 20 June 1962 (20.06.62), column 1, line 15 - column 2, line 27, figures 1-2 --	1-8
A	DE 1555163 A1 (DAIMLER-BENZ AG), 12 November 1970 (12.11.70), page 6, line 16 - page 7, line 11, figures 1-2 --	1-8
A	GB 1499696 A (GENERAL MOTORS CORPORATION), 1 February 1978 (01.02.78), page 2, line 38 - line 41, figure 1 --	1-8

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

## \* Special categories of cited documents:

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Date of mailing of the international search report

10 November 1995

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International application No.

PCT/SE 95/00789

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0287278 A1 (TECHNOLOGY INVESTMENT LTD.), 19 October 1988 (19.10.88), column 3, line 56 - column 4, line 2, figure 1  --	1-8
A	WO 9005083 A1 (DAU, WOLFRAM), 17 May 1990 (17.05.90), page 3, line 24 - line 27, figure 1  --	1-8
A	US 4714132 A (HATTORI ET AL), 22 December 1987 (22.12.87), column 3, line 11 - line 14, figure 1  --	1-8
A	US 4826203 A (KIJIMA ET AL), 2 May 1989 (02.05.89), column 4, line 46 - line 51, figures 1-4  --	1-8
A	US 4998748 A (KASHIWAGI ET AL), 12 March 1991 (12.03.91), column 3, line 24 - line 34, figures 1-3  --	1-8
X	US 3147815 A (Z. ARKU-DUNTOV ET AL), 8 Sept 1964 (08.09.64), column 3, line 15 - line 40, figure 1  --	9,12
X	US 2157773 A (K.K. PROBST), 9 May 1939 (09.05.39), column 3, line 43 - column 4, line 6, figure 4  --	9
A	DE 562775 C (WILLY G. KÖHLER), 28 October 1932 (28.10.32), page 2, column 1, line 8 - line 19, figure 1  --	9-12
A	US 3379269 A (W.C. ZETYE), 23 April 1968 (23.04.68), column 1, line 63 - line 70, figure 1  --	9-12



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 95/00789

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Patent Abstracts of Japan, Vol 7, No 41, M-194, abstract of JP, A, 57-191111 (NISSAN JIDOSHA K.K.), 24 November 1982 (24.11.82)  --	13
A	GB 771745 B (MONROE AUTO EQUIPMENT COMPANY), 3 April 1957 (03.04.57), figure 1  --	13-14
A	US 2669315 A (J.P. BUTTERFIELD), 16 February 1954 (16.02.54), figure 4  --	13-14
A	US 3388762 A (P. BAUSCH), 18 June 1968 (18.06.68), figure 1  --	13-14
A	US 3603422 A (ETTORE CORDIANO), 26 December 1968 (26.12.68), figure 2  -- -----	13-14

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 95/00789

## Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2. ☐ Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
  
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

- I Claims 1-8, relate to the design of a beam for attachment of a differential gear.
- II Claims 9-12, relate to the attachment of a leaf spring.
- III Claims 13-14, relate to the design of a stabilizer.

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
  
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐

The additional search fees were accompanied by the applicant's protest.

☐

No protest accompanied the payment of additional search fees.

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

02/10/95

International application No.  
PCT/SE 95/00789

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
DE-B-	1132006	20/06/62	NONE		
DE-A1-	1555163	12/11/70	DE-A-	1780687	29/08/74
			FR-A-	1544300	00/00/00
			GB-A-	1177580	14/01/70
			US-A-	3557896	26/01/71
GB-A-	1499696	01/02/78	US-A-	4057120	08/11/77
EP-A1-	0287278	19/10/88	SE-T3-	0287278	
			AU-A-	1434288	13/10/88
			DE-A, T-	3882161	12/08/93
			ES-T-	2043812	01/01/94
			IE-B-	62484	08/02/95
			US-A-	4848789	18/07/89
WO-A1-	9005083	17/05/90	DE-A-	5890529	16/09/93
			EP-A, B-	0441818	21/08/91
US-A-	4714132	22/12/87	JP-A-	62105709	16/05/87
US-A-	4826203	02/05/89	DE-A, C, C	3812431	03/11/88
			JP-B-	7035121	19/04/95
			JP-A-	63258205	25/10/88
US-A-	4998748	12/03/91	DE-A, C-	4010922	11/10/90
			JP-A-	3050010	04/03/91
US-A-	3147815	08/09/64	NONE		
US-A-	2157773	09/05/39	NONE		
DE-C-	562775	28/10/32	BE-A-	377461	00/00/00
			FR-A-	712470	00/00/00
US-A-	3379269	23/04/68	GB-A-	1130280	00/00/00
GB-B-	771745	03/04/57	US-A-	2753007	00/00/00
US-A-	2669315	16/02/54	NONE		
US-A-	3388762	18/06/68	DE-B-	1288456	00/00/00
			GB-A-	1068494	00/00/00
			GB-A-	1068499	00/00/00
US-A-	3603422	26/12/68	DE-A-	1903640	04/09/69
			FR-A-	1597363	22/06/70
			GB-A-	1189095	22/04/70